Blueshift - April 17, 2009

[intro music]

Sara Mitchell: Welcome to the April 17th, 2009 episode of Blueshift, brought to you from NASA's Goddard Space Flight Center. We're bringing the Universe closer to you with each episode... and this time, we want to talk about how we do it. Our observing satellites and other technologies aren't just created overnight. You probably don't hear too much about them until they're getting close to launch. But it takes years of development, building, and testing to put together such complicated and powerful scientific instruments. Goddard has a large and talented engineering community dedicated to designing and perfecting the technology used in space science. We wanted to get a little insight into how new things are invented around here, so we talked to Dr. Harvey Moseley, an experimental astrophysicist here at Goddard with a knack for thinking outside the box.

Harvey Moseley: My name is Harvey Moseley, I'm a senior astrophysicist at Goddard Space Flight Center. I'm in the Observational Cosmology Lab, and I suppose my role at Goddard is that I figure out how to build experiments that can do interesting measurements about the Universe. At NASA, we have a charter to try to discover and to understand the basic physics of the Universe. We are interested in understanding how the Universe started, how it grew from the very smooth Universe that we observe in the cosmic background radiation as seen by the COBE satellite, for instance, into a Universe now that is very broken into stars, galaxies, and very, very different from this incredibly smooth Universe of 13.5 billion years ago.

Harvey: One of the primary problems that we have is - what is really required? What are the missions that are required to do this, you know, in terms of trying to come to a position where you actually get some insight into not only how to build things, but what things are worth building. Which I think that you can't stress too much how important that is, knowing which things to build. Because the available palette of tools for the experimenter right now is tremendous, I mean technology has just opened up a wide new Universe for people to design things with, and you can build almost anything now. And the key is to make sure that you use your powers only for good, like superheroes, you want to make sure that you're only going to get to build a few things in your career, and if you pick the wrong things you can waste a lot of time. So knowing which things are really going to have a significant impact on your chosen field is really the important thing. It's very tempting to want to use all of the exciting new tools, but that's sort of not the business we're in. We're in the business of trying to advance the astrophysics and to answer some very basic questions about the Universe. And you need to make sure that when you do this, that you're pushing in the right direction.

Harvey: In a program like this, having technologies to develop is a very frightening prospect, because these projects have huge inertia. And if you were in the business of having to do technological development, you're like the little guy in the cartoons who's running in front of the train, looking back and it's about to run over him. So this is not a position you want to be in. On the other hand, the only items that you will ever try to do in a program like this are those on which the scientific success of the mission really lies. So that's motivation for doing it. Having determined what these things are, what these technologies are that need to be developed, then you basically have to divide and conquer. That is, you have to have people who have ideas about how to carry out each one of these things, you assemble teams to do each one of those things.

Harvey: When we began to develop a new concept, one of the hardest questions is, what's the first step? How do you know what direction to head from that first step, that is, how do you actually plan the unplannable? The primary thing that you have to start out with is, you have to have demonstrated to yourself that this invention, if successful, really will make a difference. If the answer to that is yes, then you can go to step two. If it isn't, then find something better to do. But if it can make a real difference, then you go to step two. Step two is, is there a simplified version of this that you can come up with in your head, which first of all, would make it very clear to others why this is a important thing

to do and would show that the development is in fact possible and likely to succeed. It doesn't have to have all the bells and whistles, but it has to - in some sense, early on you have to demonstrate that the hard part can work. If what people will perceive of as the hard part has been demonstrated, then it's much easier to convince people that you can make the supporting elements of it work.

Harvey: The other thing that is absolutely essential is that you have to have a constant vigilance. You have to say, what's wrong with what I've got? And what's going to go wrong in the future? Because you know it's going to, and by anticipating those things you can be ready to handle them when they arise. The one thing that is so critical is the way you get things done in a reasonable amount of time is not to be right every time, but you have to be fast. Because you can't be right every time, and you have to be able to recover from wrong decisions. So speed, and accuracy, and never making the same mistake twice - that is, learn from the mistakes when you make them - are really the keys, I think, to doing development of this sort.

Harvey: I'm a professional tinkerer, to some degree. I grew up on a farm, and we still own the farm, and I go down there, I don't know, once or twice a month. And we still have animals on it, and so on. And people say, oh, how wonderful it must be to have something that's such a change of pace. And I said, well, that's not actually right. I said, because when I'm at work, if you stop and think about what I really do, I spend most of my time fixing broken things. Because in this development process, the straight path wouldn't take you very long to get from one end to the other of the development. So what you really spend all of your time doing is fixing broken things, and if I go down to my farm I end up fixing broken things. It's probably less by choice than by inclination. Whatever else I want to do in life, I think I'm going to have to do this. I'm going to have to continue to do this.

Sara: To hear about one of the inventions Dr. Moseley has worked on for the James Webb Space Telescope, check out our website at universe.nasa.gov/blueshift

Sara: We've also got a place for you to send us feedback about what you heard and tell us what you'd like to hear on Blueshift in the future! We'll be back in a couple of weeks to share some highlights from our events during the 100 Hours of Astronomy, and take you on a walk you won't soon forget. This is Sara Mitchell, bringing the Universe closer to you with Blueshift.

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